USER MANUAL

LXI 7-SLOT MODULAR SWITCHING CHASSIS
(MODEL No. 60-102)

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pickering

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SECTION 1 - INTRODUCTION

GENERAL

The 60-102 is fully compliant with the LXI Class C specification and supports Pickering Interfaces 3U PXI switching modules. Each module is supported as though it is an LXI compliant device, complete with a driverless soft front panel that provides complete control of the module functions. The 60-102 supports up to 7 off 3U modules and is equivalent to an 8 slot PXI chassis.

The chassis allows the majority of the large number of 3U PXI modules from Pickering Interfaces to be installed and controlled through a standardized Ethernet interface. The chassis is supplied with a built-in generic IVI driver to control the PXI modules in accordance with the LXI specification, but can also be controlled through a kernel driver.

Modules available for installation in the 60-102 chassis cover a large variety of switching functions. They include simple switches, matrices and multiplexers based on reed relay and electromechanical technology which can switch from micro Amps to 40 Amps. A range of RF, microwave and optical switching functions are supported as well as some instrument functions such as variable resistor cards. For a list of compatible PXI modules, please refer to the LXI Short Form Catalog.

The LXI compliant Ethernet interface enables the chassis to be controlled through standard LAN interfaces found on all controllers. It allows the remote operation of switching products with simple cabling over long distances, even permitting a chassis to be controlled over world wide networks. The separation of the chassis from the controller's PCI bus simplifies power-on sequencing of systems and provides a high degree of independence from the migration of the Windows and VISA environment

The form factor of the 60-102 allows efficient use of space thanks to its half rack width size and compact 4U height. Two 60cfm fans insure maximum module cooling and an efficient direct convection design allows the chassis to operate over an extended ambient temperature range of 0ºC to +55ºC..

The low acoustic emissions make the chassis ideal for applications such as office or laboratory environments where noise levels are critical. The sound pressure level varies between 41.6dB and 47.3dB dependant upon the fan speed which is automatically controlled according to the internal chassis temperature.

The 60-102 can be simply configured over its LXI compliant interface using any industry standard web browser. The interface can be used to load a Java based soft front panel to the user for any of the modules fitted to the chassis, permitting users to manually access modules without the need for drivers on the controller.

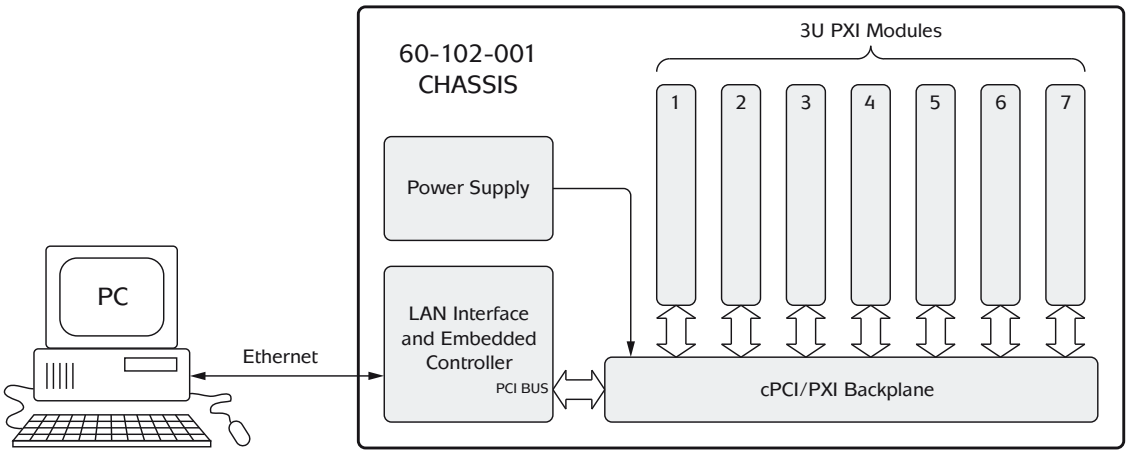

Figure 1.1 - Basic Block Diagram for the 60-102 LXI Chassis

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SECTION 2 - SPECIFICATION

Specification

Chassis Backplane:	64 bit backplane, compliant with cPCI/PXI specification. Provides trigger, local bus support (subject to module support).
Chassis Capacity:	7 off 3U user slots available.

PXI Module compatibility

The chassis is supplied with drivers for Pickering system 40 switching modules.

Switching Support	All of 3U Pickering Interface's PXI switching modules. Includes (but not limited to): All 2 and 4 slot 3U BRIC matrices, featuring up to 2208 crosspoints.
Instrumentation support:	Programmable resistor and potentiometer cards.
Soft Front Panel:	All supported PXI modules can be controlled through a W3C compliant web browser (Internet Explorer, Firefox, Netscape and others).

For a selection guide on the range of modules capable of being hosted by the 60-102 chassis, please see the PXI Module Selection Guide in the LXI Short Form Catalog. This is available as a download from the On-Line Catalogs section of our website: www.pickeringtest.com

Programming

All LXI modules are supplied with built-in software drivers, web pages for configuration and soft front panels as required by the LXI specification.

A variety of drivers are provided (C, .NET, IVI, SOAP) which are compatible with Windows 2000/XP operating systems and may be used in many commonly used programming environments including:

- **National Instruments** (LabVIEW, LabWindows/CVI, Switch Executive, Test Stand, MAX etc.)
- **Microsoft Visual Studio** (Visual Basic, Visual C++, Visual C#)
- **Agilent VEE**
- **Mathworks Matlab**

As well as various open source environments such as:

- **Sharp Develop**
- **Dev-C++**

Power Supply

Input Voltage Range:	100 - 240VAC
Input Voltage Frequency:	40 to 60Hz
Input Current Rating:	8A 115VAC or 4A 230VAC

Supplied with a 350W DC output power supply with the following capacity:

DC Output	Max Current
+3.3V	20A
+5V	35A
+12V	18A
-12V	2A

Note: Combined 3.3V and 5V current, 35A Maximum.

Cooling

Airflow:	Bottom intake, top exhaust
Per-slot Cooling Capacity:	25W at 55°C ambient 40W at 40°C ambient
Fans:	2 off 60cfm fans

Acoustic Emissions

Sound Pressure Level(dBA):	Minimum fan speed: 41.6dB Maximum fan speed 47.3dB
Sound Power (dBA):	Minimum fan speed: 51.9dB Maximum fan speed 55.5dB

Monitoring

LXI Interface Status LEDs:	Power, Ready, Error, LAN, Active
Chassis Status LEDs:	Power, Temperature, Fan Speed
Web Page Monitoring:	Chassis air temperature, Backplane supply voltage levels, Fan speeds

LAN Interface

Connector:	RJ45 Connector.
Connection Speed:	100baseT interface.

Designed to comply with the LXI Standard Version 1.2 Class C

Supporting Documentation

Manuals, drivers and a copy of the short form catalog are stored internally and are accessible through any browser compliant with W3C standards.

Width and Dimensions

Dimensions:	Width: 280mm (11.02") Height: 177mm (6.97") Depth: 303mm (11.93") For rack mounting, recommended to be mounted in 5U to allow free bottom intake of air.
Weight:	5.9kg (13 lbs) without PXI modules

Safety, CE & RoHS Compliance

All modules are fully CE compliant and meet applicable EU directives: Low-voltage safety EN61010-1:2001, EMC Immunity EN61000-6-1:2001, Emissions EN55011:1998.

The 60-102 Chassis also complies with the European Restriction of Hazardous Substances directive (RoHS).

Product Order Codes

LXI Modular Switching Chassis, 7-Slot	**60-102-001**
Optional 19" rack mounting hardware:	**63-102-001**

Latest Details

Please refer to our Web Site for Latest Product Details.
www.pickeringtest.com

Operating/Storage Conditions

Operating Conditions (operating with specified airflow)

Operating Temperature:	0°C to +55°C
Humidity:	10% to 95% non-condensing

Storage and Transport Conditions

Storage Temperature:	-20°C to +70°C
Humidity:	10% to 90% non-condensing

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SECTION 3 - GENERAL DESCRIPTION

MECHANICAL DESCRIPTION

The 60-102 LXI Chassis comprises the following:

- Half width rack chassis suitable for desk top operation.
- 7 slot PXI/cPCI compatible backplane.
- Controller module for providing the interface between the backplane and the Ethernet port.
- Power supply assembly for providing power for the Microcontroller, backplane and peripheral cards.
- Front panel mounted chassis status LEDs.
- Front panel mounted LXI interface status LEDs.
- Rear panel mounted RJ45 100baseT LAN connection for LXI control of the module over Ethernet.
- Rear panel mounted IEC plug for connection to the mains supply.

FUNCTIONAL DESCRIPTION

The 60-102 LXI Chassis is capable of supporting a wide range of PXI switching cards in a self-contained unit, the only connections required are power and an Ethernet lead. The chassis consists of a 7-slot PXI/compactPCI compatible backplane and a controller card with power being supplied from an internal mains power unit. Control and programming information for the PXI modules installed in the chassis is sent to the backplane via a PCI bridge device on the controller card. Programming information for the controller is sent to the chassis via the LAN interface from a remote computer using the chassis unique Ethernet address. Programming documentation for the chassis as well as data for Pickering's LXI compatible switching products is stored in the embedded processor on the controller card and can be downloaded over the LAN interface. LXI Status LEDs on the front of the chassis indicate condition of the LAN interface. A chassis management system monitors the status of the backplane power rails, the chassis temperature and the speed of the cooling fans. The status of the chassis is indicated on three front panel LEDs and is monitored by the controller card where it can be accessed over the LXI interface.

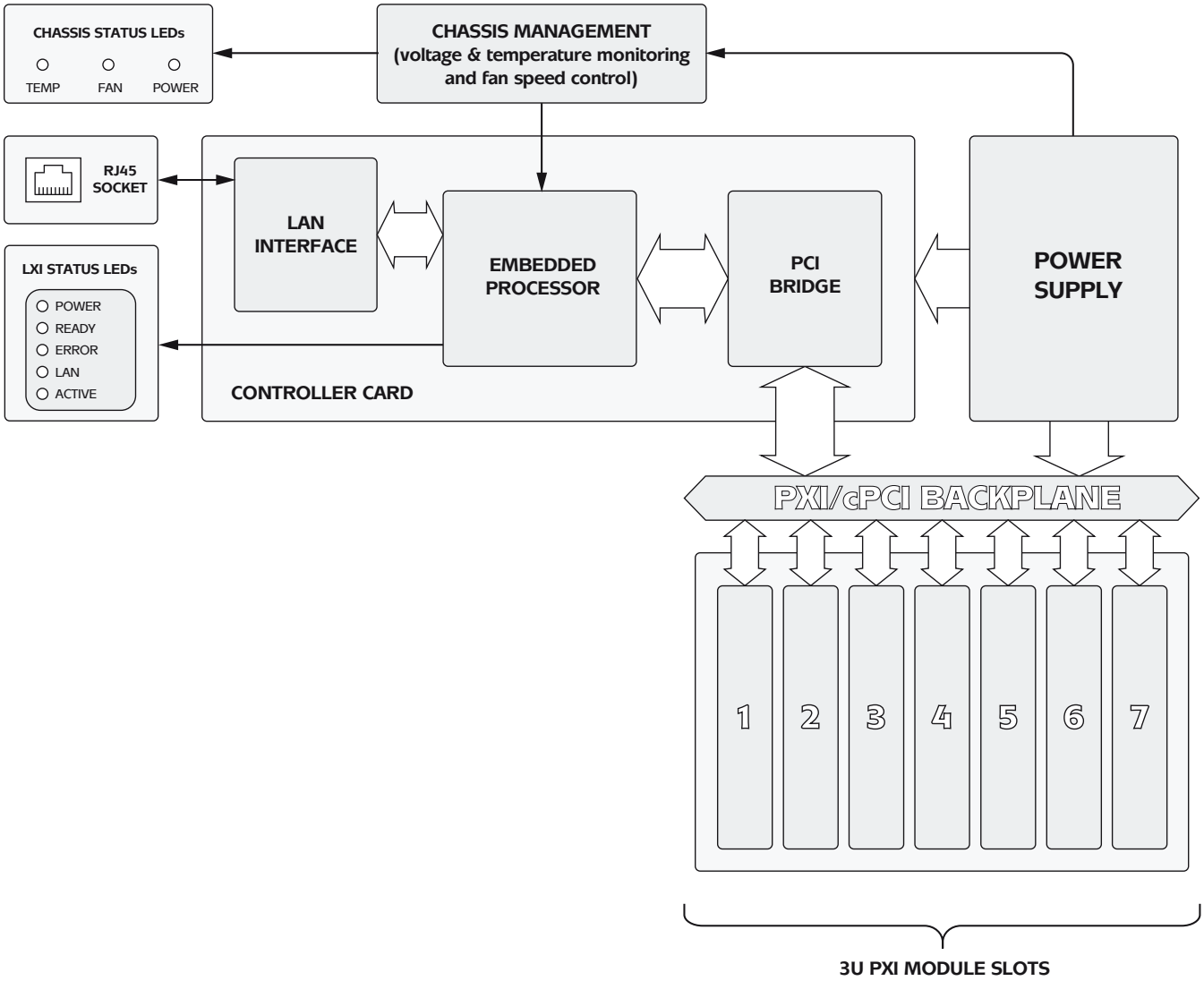


Figure 3.1 - Block Diagram for the 60-102 Seven Slot LXI Chassis

SECTION 4 - INSTALLATION

INSTALLING THE LXI CHASSIS

Site Considerations

The 60-102 is designed to operate on a bench and is supplied fitted with feet fitted that allow the front of the unit to be tilted upwards. It should be noted that there is an air intake in the underside of the chassis therefore it is important not to allow any restrictions underneath the unit.

The chassis can also be mounted in a 19 inch rack on a suitable equipment shelf or using Pickering's rack mounting hardware 63-102-001. In this situation, the unit should be allocated 5U of rack space and must have its bottom feet inplace to ensure the correct flow of cooling air.

Figure 4.1 - Front of the 60-102 LXI Chassis

Cooling Considerations

The chassis draws cooling air for the PXI modules through an intake in the underside of the chassis directly below the PXI slots (see Figure 4.2). It is important not to block the passage of air into this intake.

Figure 4.2 - Underside of the 60-102 LXI Chassis showing air intake for the PXI modules.

The 60-102 expels cooling air through an exhaust vent in the top panel (see Figure 4.3 below). When the chassis is in use, make sure that this outlet is not restricted in any way.

To maintain the correct internal air flow, ensure that all unused PXI module slots in the chassis have blank front panels fitted.

Figure 4.3 - Top of the 60-102 LXI Chassis showing cooling air outlet for PXI slots

The 60-102's internal power supply draws cooling air through an inlet in the left hand side panel and expels air through an aperture in the rear panel (see Figures 4.4 and 4.5). During installation, It is important to ensure that these vents are not restricted and any cabling is routed away from all air inlets and outlets.

Figure 4.4 - Left side of the 60-102 LXI Chassis showing cooling air inlet for the power supply

Figure 4.5 - Rear panel of the 60-102 LXI Chassis, air outlet for the power supply's cooling fan is above the power input connector

Rack Mounting The Chassis

The 60-102 can be fitted into a standard 19 inch equipment rack using the optional 63-102-001 Mounting Kit. The kit consists of a frame into which the chassis is mounted that increases the overall height to 5U and allows space for cooling air to be drawn into the underside and expelled from the top of the chassis.

For instructions on how to assemble the rack mounting kit, refer to Appendix A.

WARNING: ***When fitting into a rack it is important to provide adequate support using side brackets or runners, the mounting holes in the front panel flanges are designed only for securing the device in the rack and must NOT be used to support the weight of the whole device.***

Figure 4.6 - The 60-102 LXI Chassis fitted into the optional 63-102-001 Rack Mounting Kit

Connecting Safety Ground

WARNING

THE 60-102 CHASSIS IS DESIGNED WITH A THREE-POSITION IEC CONNECTOR THAT CONNECTS THE GROUND LINE TO THE CHASSIS GROUND. TO MINIMIZE SHOCK HAZARD, MAKE SURE YOUR ELECTRICAL POWER OUTLET HAS AN APPROPRIATE EARTH SAFETY GROUND THAT IS CONNECTED WHENEVER YOU POWER UP THE CHASSIS.

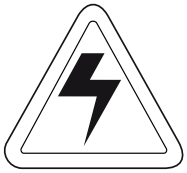
IF YOUR POWER OUTLET DOES NOT HAVE AN APPROPRIATE GROUND CONNECTION, YOU MUST CONNECT THE FACTORY WIRE SAFETY GROUND TO THE CHASSIS. TO CONNECT THE SAFETY GROUND, COMPLETE THE FOLLOWING STEPS:

1. Connect a 16 AWG (1.3 mm) wire to a chassis grounding screw using a toothed grounding lug. The wire must have green insulation with a yellow stripe or must be non-insulated (bare).

2. Attach the opposite end of the wire to permanent earth ground using toothed washers or a toothed lug.

INSTALLING PXI MODULES

CAUTION



WARNING - DANGER OF ELECTRIC SHOCK
BEFORE REMOVING A MODULE FROM THE CHASSIS ENSURE THAT ALL CONNECTIONS TO THE MODULE ARE REMOVED

Electrostatic discharge can damage the components on the module. To avoid such damage in handling the board, touch the anti-static bag to a metal part of the chassis before removing the board from the bag.

Ensure that there will be adequate ventilation for the module when fitted into the chassis.

The module should be installed in accordance with the following procedure:

1. Do not attempt to install, or remove, modules with the user connection attached. The UUT should be electrically and mechanically disconnected from the chassis.

2. Handle all PXI modules as you would any other static sensitive device. Ensure that the bag containing the PXI module is at the same voltage as the chassis by touching both at the same time. Store any modules being removed in a static protection bag.

3. Ensure that the system is turned OFF but still connected to mains so that it remains grounded.

4. Choose an appropriate slot in the rack.

5. Remove the blanking plate for the chosen slot.

6. Ensure that the injector/ejector handle is in its downward position. Align the module with the module guides on the top and bottom of the slot.

CAUTION

Do not raise the injector/ejector handle whilst inserting the module. The module will not insert properly unless the handle is in its downward position.

7. Hold the handle whilst slowly sliding the module into the module guides until the handle catches on the injector/ejector rail (refer to Figure 4.6).
8. Raise the injector/ejector handle until the module firmly seats into the backplane. The front panel of the module should be flush with the front panel of the chassis.
9. Screw the front panel of the module to the front panel mounting rail.
10. Power up the chassis and wait for the green Ready light.

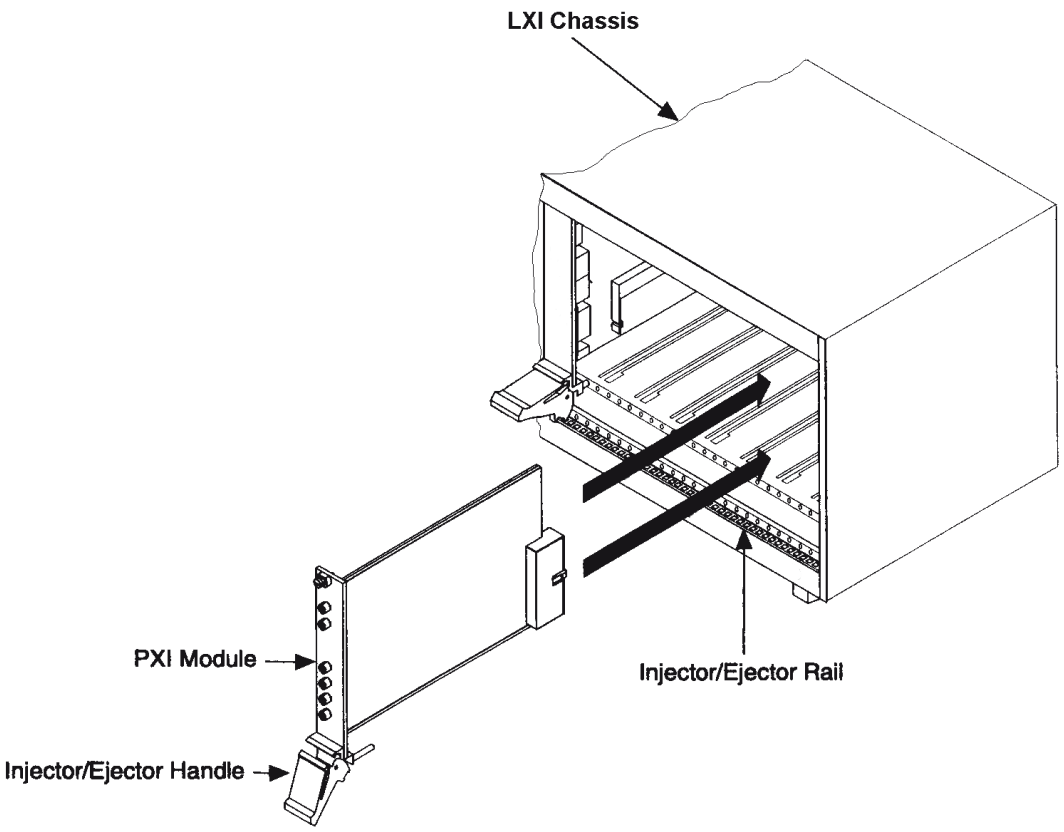


Figure 4.6 - Installing a module into the LXI Chassis

EXPANDING THE 60-102 CHASSIS

It is possible to expand a single 60-102 to include an external PXI chassis, such as 40-914. This allows the number of available to modules supported by 60-102 to be increased from 7.

To expand the 60-102 the user should add a 41-921 PXI interface into the 60-102 and connect it to a PXI chassis with a second 41-921 installed in Slot 1. The set up requires no installation of additional software. The modules in the PXI chassis appear as an extension to the modules fitted into the 60-102 – the fact that they are in a separate chassis is transparent to the user.

The following should be noted with this set up:

- As with the 60-102 only Pickering Interfaces modules can be supported in this way, third party modules are not supported because of the need for suitable drivers.
- National Instruments MXI-4 interface cards can be used for expansion instead of the 40-921 but the use of MXI-3 cards is strongly discouraged. There are known documented issues with MXI-3 when operated with fast PCI interfaces which have been corrected on MXI-4.
- The number of modules supported can be increased by adding further slave PXI Chassis.
- If the LXI chassis is extended in this manner, it is important to make sure that the PXI chassis powers up prior to the LXI chassis.

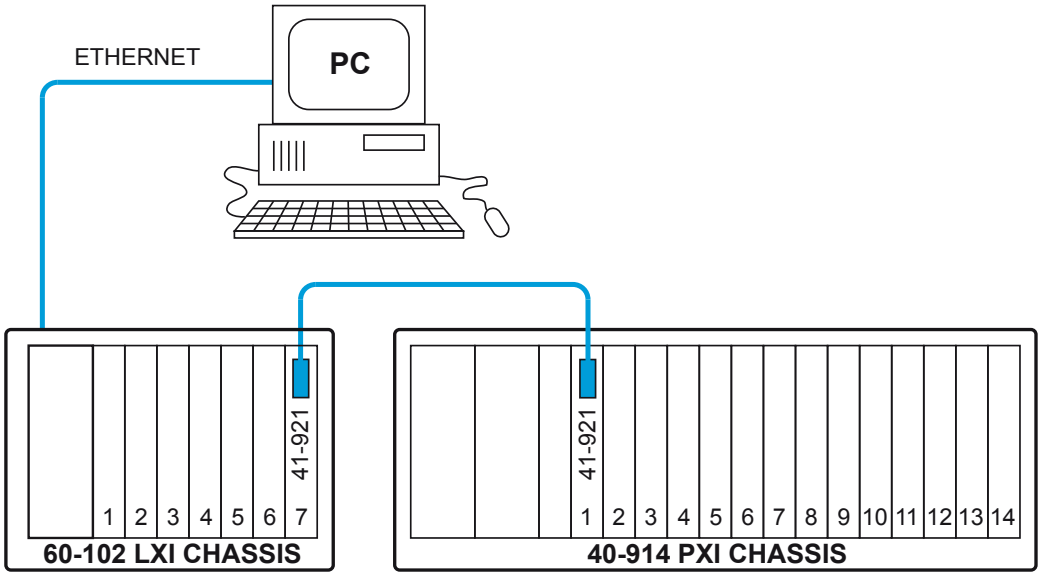
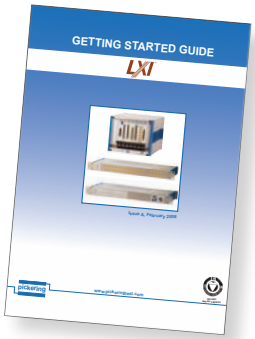


Figure 4.5 - Diagram Showing the Expansion of the 60-102 LXI Chassis

SECTION 5 - CONFIGURATION & SETUP

HARDWARE SETUP

Before you begin, take a moment to check your box contents to ensure you have the necessary components present. Contact your local sales office if you find that any part or component is missing.



Your box will contain:

1. A 60-102 LXI Chassis
2. The document entitled ‘Getting started with your LXI device’.
3. Two 2 metre ethernet patch leads:
   One labelled “Crossover” (grey) and the other “Straight-Through” (blue)
4. A power lead for your territory
5. A driver CD

You may also have a number of additional cards. Check your shipping invoice for details.

Remove your 60-102 chassis from its protective packaging.

Next, insert your option cards into the chassis. You may need to remove blanking panels to fit your cards. Retain these panels, as the chassis will not be cooled correctly with a card removed if these are not fitted.

If you are using an ethernet hub or switch, use the Ethernet cable marked “Straight-Through”. Connect one end to the socket on the back of your 60-102 chassis, and the other to a free socket on your hub or switch. If you are connecting directly from your computer to the LXI device, use the Ethernet lead marked “Crossover”.

Insert the power lead into the socket on the back of your chassis and plug the other end into a mains electricity socket. You can now power up the chassis by first operating the switch on the rear panel below the mains inlet, then operating the power switch on the front of the chassis in the lower right corner. The three status lights “Temp”, “Fan” and “Power” should be illuminated.

Your chassis will now start going through its boot up procedure which can take up to twenty seconds to complete. On the Controller Module, a green “Ready” light should illuminate along with the “LAN” and “Power” lights if everything has worked correctly. If not, check your Ethernet connection. If you have an error light proceed to the troubleshooting section of this manual for further assistance.

CONNECTING THE 60-102 CHASSIS

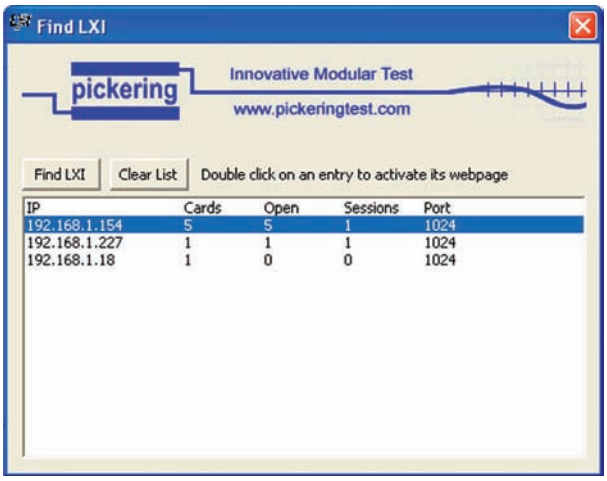
Control of the 60-102 chassis is through a web server at the devices IP address. From the web server the user can also access drivers, utility programs and documentation. So, it is important to first establish the IP address that your LXI device is using.

By default, Pickering LXI devices are configured using DHCP to acquire a TCP/IP address. By matching the MAC address listed on the rear of the device, with the lease log on your DHCP server, you can determine your LXI device's address and proceed to configuring your 60-102 chassis settings.

If you do not have a DHCP server, you must ensure that your computer is set to use Auto-IP as its TCP/IP configuration method. This is the default fallback condition under Windows XP if you set your computer for DHCP and it cannot locate a server.

You can then establish your LXI chassis' TCP/IP address using one of three Discovery Tools.

The Pickering Discovery tools located on the CD included in your box can tell you the TCP/IP address your chassis is using. To use the CD, insert it into you computer's drive and wait for it to auto-run. On the first screen select *LXI PRODUCTS*.



1) Find LXI – a simple Windows application which will list all Pickering LXI devices. The home page of an LXI device is displayed when the corresponding IP address is highlighted and *Open Browser* selected.

2) VXI-11 Discovery protocol
Some tools, for example Agilent IO Library, provide a VXI-11 protocol discovery tool. This may be used to establish the address of any connected LXI compliant device.
A VXI-11 Discovery browser is supplied on the distribution CD and may be used to locate any LXI device, Pickering or otherwise. To run this, select the *VXI-11 Discovery* application.

3) Bonjour or Rendezvous discovery protocol (recommended)

By default, Pickering LXI devices have the Bonjour or Rendezvous service switched on, by using a suitable Bonjour client on your computer, you can search for and configure an LXI device without knowing its TCP/IP address beforehand. Use the MAC address on the rear of the chassis and that present on the LXI devices homepage to confirm you are configuring the correct device if you have more than one LXI device running.

A Rendezvous browser is shipped on the CD, to use it click on the Rendezvous icon.

Then click on *Web Server (HTTP)*.

A list of devices and MAC addresses should be displayed. Double click on the device with the same model number and MAC address as the 60-102 chassis you are using (the MAC address is printed on the rear of the unit under the serial number).

The IP address of the device will be displayed in the browser's address field in the format:

http://169.254.59.99/path=/

delete the /path=/ section of the address and press Return to display the 60-102 Chassis Home Page.

All the discovery tools are located on the Pickering distribution CD in the LXI Products/Tools directory.

Once you have a valid IP address, you can move on to configuring your LXI chassis' settings.

CONFIGURING THE 60-102 CHASSIS SETTINGS

As you now know your device's TCP/IP address, you can proceed to configure the chassis to your requirements.

This section describes the basic procedure for configuring the chassis. If any problems are encountered, please refer to the "LXI Getting Started Guide".

Type your device's IP address into the address bar of your web browser in this format:

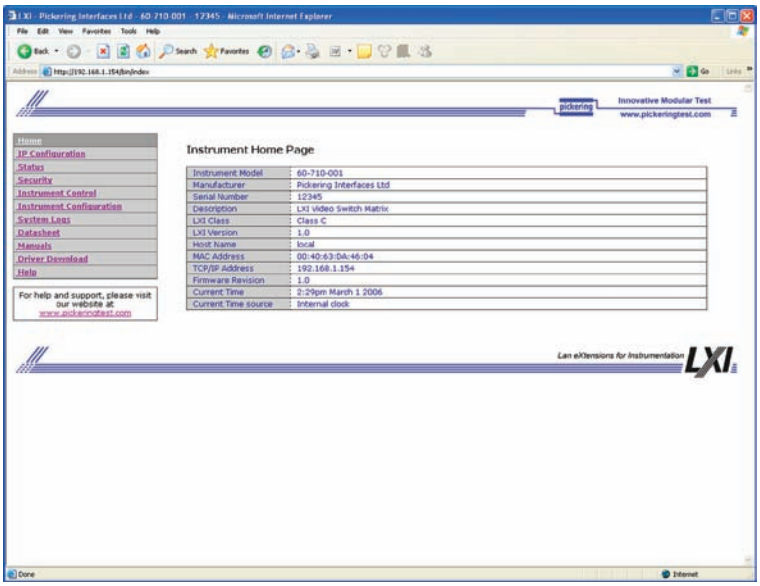
http://<IPNUM>

Replacing <IPNUM> with the address your LXI chassis is currently using.

I.e. if your LXI chassis has been issued an address of 192.168.1.50, then type the following into your browser address bar:

http://192.168.1.50

You will now be presented with your LXI chassis embedded homepage. This page lists the devices settings, LXI class and model number. Use the MAC address listed on this page and that on the rear of your chassis to confirm you are configuring the correct device if you have more than one.

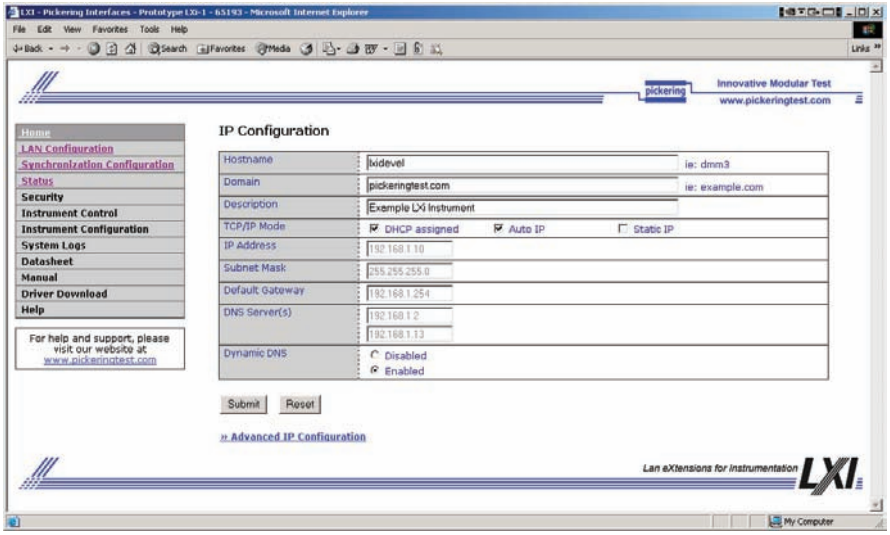


Clicking on IP Config will take you through to the main configuration screen for your chassis. It is here that you can set the method the chassis uses for acquiring a TCP/IP address.

There are three main ways of configuring your LXI chassis' TCP/IP address:

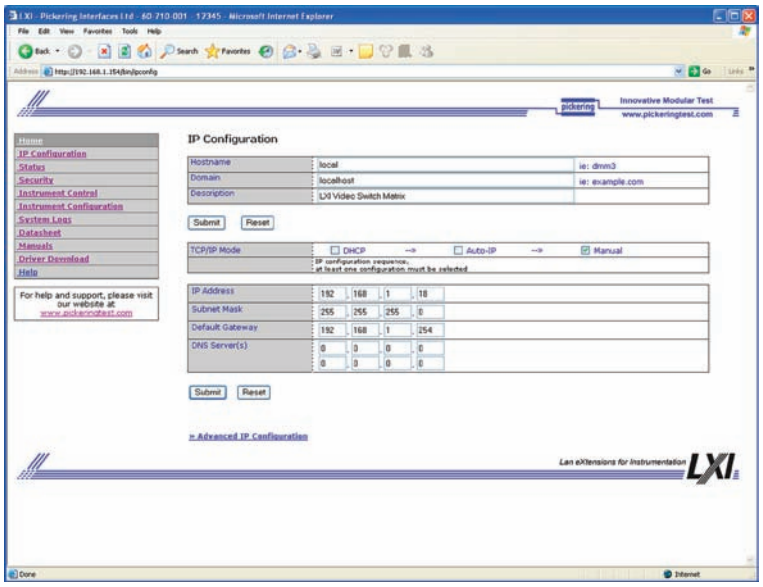
1. DHCP, a server issues IP addresses from a pool and ensures that no two devices can have the same IP address.
2. Where no DHCP server exists, Auto-IP negotiates with other devices to choose an IP address that does not conflict. This is the default condition a Windows based computer reverts to if it is configured for DHCP but there is no DHCP server present.
3. Static IP, address settings are manually entered and care must be taken to ensure that the settings chosen do not conflict with other devices present on the network.

Note: Contact your network administrator if you are unsure as what these settings should be, also refer to the information overleaf.



More than one addressing scheme may be enabled if required. By default Pickering LXI devices ship with DHCP and Auto-IP enabled. If the LXI chassis fails to acquire a TCP/IP address by using DHCP, it reverts to using Auto-IP. This fail over process is designed to ensure you can still communicate with your chassis in the event of a server failure.

Note that at least one configuration method must be enabled at all times.



SETTING THE IP ADDRESS

To use the 60-102 LXI Chassis over a LAN connection it should be set up and configured as described earlier in this section or in the “LXI Getting Started Guide”.

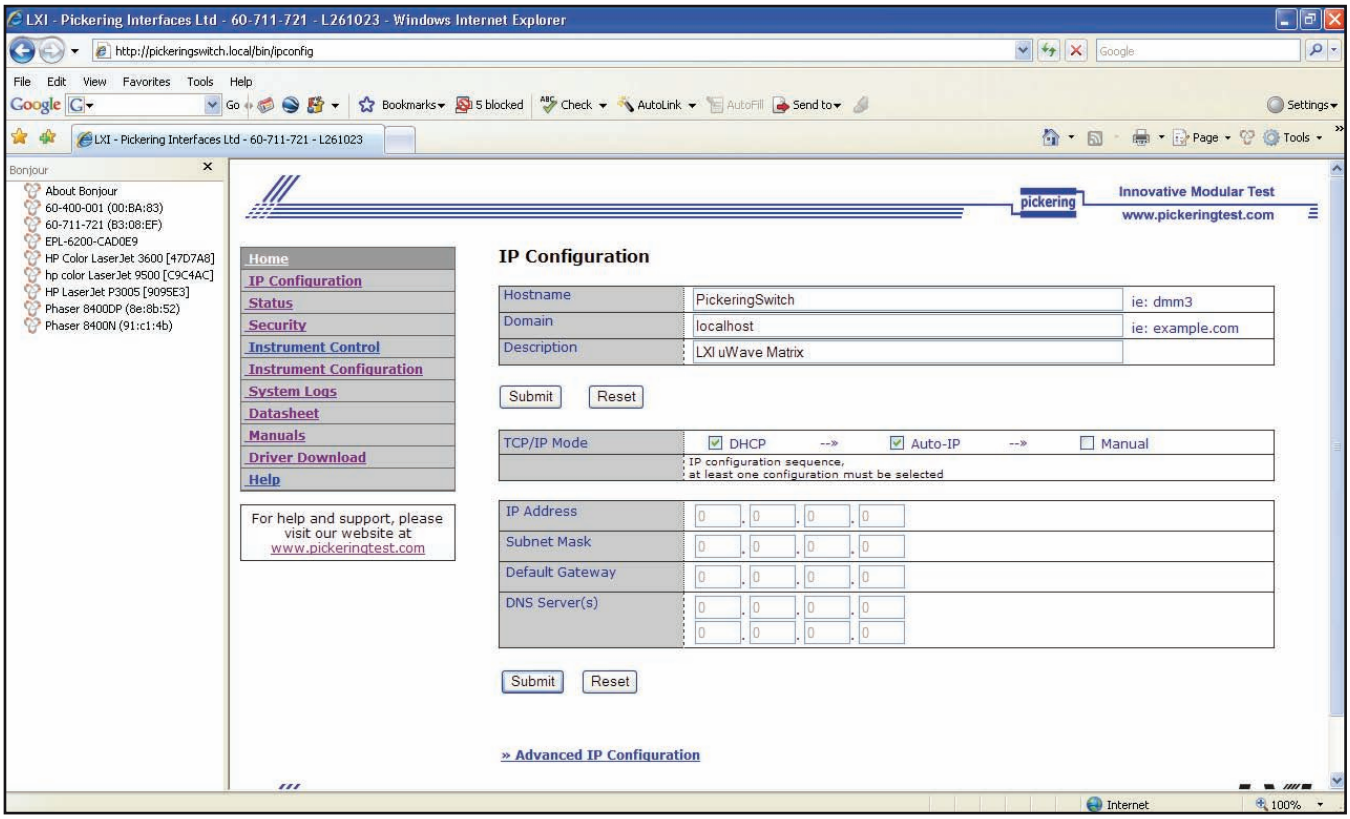
If the IP address is to be set manually and before connecting to a network, contact your IT department so they can give you the correct settings for:

- IP Address
- Subnet Mask
- Default Gateway
- DNS Server(s)

Once you have the required information, the IP configuration window is used to manually set the IP address. This is shown in the figure below.

Incorrect setting will result in a loss of communication indicated by a red LAN LED on the front panel of the Controller module.

If this does occur press and hold the reset button on the front panel of the Controller module for a full factory reset.



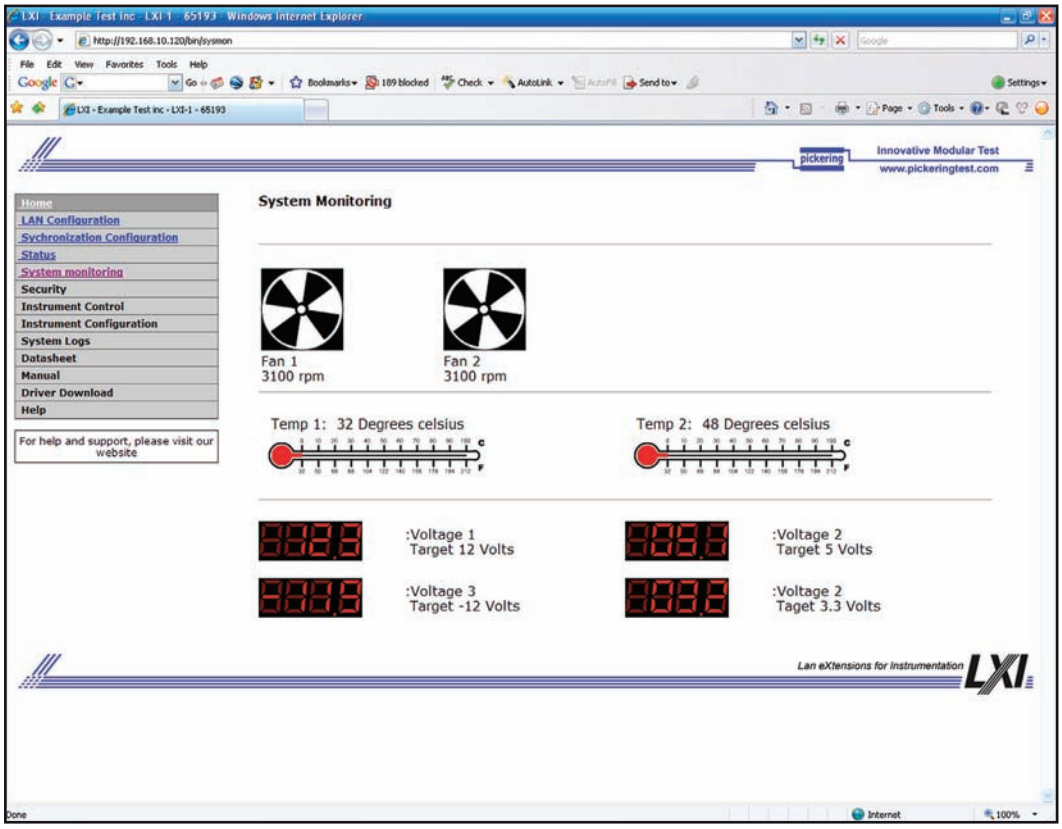
CHASSIS MANAGEMENT SYSTEM

The 60-102 has a built in management system that monitors the internal chassis temperature and varies the fan speed accordingly. The system also monitors the power supply's voltage rails and speed of the fans and indicates the chassis' status on three front panel LEDs. The meaning of these LEDs is outlined in the table below.

LED		Status		
Name	**Color**	**On**	**Off**	**Blinking**
Power	Blue	DC voltage supplies are normal	No DC power is supplied	5 V or 3.3 V is outside the ±7% range, 12 V or -12 V is outside the ±12% range
Fan	Green	Fans are operating normally	The system is off	Any of the fans is operating at a speed lower than 500 RPM
Temp	Amber	The chassis temperature is normal	The system is off	Chassis temperature exceeds 50ºC

When the management system detects a fault condition, as well as indicating the chassis status by blinking the appropriate LED, an audible alarm is also triggered. This alarm can be defeated by pressing the recessed Reset button on the left of the chassis front panel below the Power LED. It should be noted that operating the reset only silences the alarm, and the cause of the fault should be rectified for continued correct operation of the chassis. The position of the LEDs and the Reset button is shown below.

The chassis status information can also be accessed via the LAN interface. Select “System Monitoring” on the 60-102 homepage to display a page showing the speeds of the cooling fans, the levels of the power rails and the internal chassis temperature. An example of the monitoring page is shown in the graphic below.



SECTION 6 - PROGRAMMING

Programming options for Pickering Interfaces LXI Units

Software drivers are supplied for Microsoft Windows 2000/XP operating systems, with specific support for the following development environments:

- Microsoft Visual Basic
- Microsoft Visual C++
- National Instruments LabWindows/CVI
- National Instruments LabVIEW

Windows drivers are supplied in the form of Dynamic Link Libraries, which should also be usable in any other development environment that supports them.

A number of different Windows drivers are available to meet particular system requirements, these drivers are generally 'universal', handling all models in the System 60 range.

Some interfaces may also be used on other operating systems, for example the SOAP interface.

Please note that documentation is available in its most up-to-date form as HTML help files, fully hyperlinked for easy access.

The principal drivers provided are:

IVI Driver for Windows - pi40iv

The pi40iv IVI (Interchangeable Virtual Instrument) driver supports all Pickering Interfaces PXI switch cards that are consistent with the Iviswtch class model - as are the great majority of cards in the System 40/45/50 ranges and all System 60 LXI units. It integrates well with LabWindows/CVI and LabVIEW, and is fully compatible with Switch Executive. It is also usable in general-purpose programming environments such as Visual C++ and Visual Basic.

Prior installation of the VISA and IVI Compliance Package from National Instruments is required for the correct installation and operation of this driver.

Direct I/O Driver for Windows - piplx

The piplx driver accesses cards directly, without using a VISA software layer. It is most commonly used in general-purpose programming environments such as Visual C++ and Visual Basic and can usually be adapted to work from other programming environments.

SOAP

Each Pickering LXI unit contains a SOAP interface which permits the unit to be controlled from any programming environment capable of handling SOAP. This includes Perl and .NET.

LabVIEW and LabWindows

LabWindows fp files and LabVIEW libraries are provided for pi40iv and piplx, allowing the LXI unit to be controlled from these environments.

NOTE: At the time of writing, the above drivers do not support LabViewRT.

Details of the above drivers are available in separate documentation found in the installation folders.

Unit Architecture

Before discussing individual drivers it is important to understand the basic architecture of Pickering LXI units.

IP Address, Bus and Device

Each LXI unit has a unique IP address on your network. This address will depend on how you have configured your LXI unit and on network configuration. As delivered most LXI units are configured for dynamic address allocation, that is your network is expected to provide the IP address for the unit as part of its power-up sequence. This address may be configured as a fixed address, but there are possible problems, refer to the Getting Started guide for details on how to discover and configure your LXI unit.

Within an LXI unit, each switch card occupies a PCI slot, and so has a unique bus/device location with the embedded computer. It is vital to know that location in order to specify the address of the switch to be controlled.

Pickering provide software tools to help you discover the bus and device number of the cards in your LXI unit. Refer to the distribution disk that came with your unit in the folder LXI Products/Tools.

Sub-units

Pickering PXI cards contain one or more independently addressable functional blocks, or sub-units. Sub-unit numbers begin at 1, and separate sequences are used for input and output functions. This number is used in function calls to access the appropriate block. Generally, sub-unit numbers correspond directly to the bank numbers specified in hardware documentation.

Sub-unit examples:

Model	Configuration	INPUT sub-unit #1	OUTPUT sub-unit #1	OUTPUT sub-unit #2	OUTPUT sub-unit #3
40-110-021	16 SPDT switches	None	16 SPDT switches	None	None
40-290-121	Dual Programmable resistors + 16 SPDT switches	None	Resistor #1	Resistor #2	16 SPDT switches
40-490-001	Digital I/O	16-channel inputs	32-channel outputs	None	None
40-511-021	Dual 12 x 4 matrix	None	12 x 4 matrix #1	12 x 4 matrix #2	None

Sub-unit characteristics

The numbers of input and output sub-units in a card can be obtained using functions from the library:

For example, in the basic piplx library:

```
PIPLX_EnumerateSubs
PIPLX_SubType, PIPLX_SubInfo
```

Are used to identify the individual sub-units on a card.

Controlling a Switch

To control a Pickering switch the command must contain the full location of the sub-unit being controlled; the IP address of the LXI unit, the bus/device location of the particular card in that LXI unit, and the sub-unit which contains the switch to be controlled.

A number of tools are available to locate the IP address of an LXI unit. Refer to the “Getting Started” guide delivered with your unit, also available on the distribution disk in the “LXI Products” folder. Only Pickering tools such as “Find LXI” will identify the switch card bus/device location. Pickering Direct I/O driver includes functions to allow a Pickering LXI unit to be found programmatically

To control a card there are a number of steps required. For example using PIPLX it is necessary to first open a session on a specified LXI unit, then to obtain a handle to a particular card in the LXI unit and finally to issue commands to a particular sub-unit on that card.

For example, to access the card at bus 0, device 20, on the LXI unit at 192.168.1.100 :

```
PIPLX_Connect("192.168.1.100", &session)
PIPLX_OpenSpecifiedCard(session, 0, 20, &card_num)
PIPLX_OpBit(session, card_num, sub-unit, bit, state)
```

Using the IVI driver, the connect and open functions are combined in the pi40iv_InitWithOptions function where the VISA resource string will specify the IP address and the card bus,device location, for example:

```
pi40iv_InitWithOptions("TCPIP::192.168.1.100::0.20::INSTR",….)
```

Here the resource string identifies an IP address of 192.168.1.100 and then the bus, device location as 0.20, that is bus 0, device 20.

For full details of how to access and use Pickering drivers the user is advised to refer to the individual documentation packs provided with the installed drivers, this can be found on the distribution disk that came with your unit.

Installing the Drivers

Once you have discovered your LXI device, follow the links on its web pages to download and install the device driver. Once installed, you will have access to the basic Direct IO driver, piplx. Instructions, help and examples may be found in the installation folder.

Further drivers are available but may need further steps for installation, for example the IVI driver, pi40iv, requires the prior installation of VISA and the IVI Compliance Package from National Instruments (NB a license may be required from NI for use of these drivers).

Command Line Control of Pickering LXI Instruments

Overview

Command line control of the Pickering LXI device range was added in firmware release 2.11. The utility provided was ported to the LXI instrument from the Windows utility PILMon and provides identical functionality.

Enabling the Command Line Control Utility

Pickering LXI devices do not provide an SSH server in the normal configuration state, the service must be explicitly enabled.

To do this the user must first enable security, this helps to prevent inadvertent access by limiting the accessibility of instrument services, principally by requiring password access to control functions. Once security is enabled, the SSH server may be started.

All the following assumes that the user knows the IP address of the LXI instrument. If this is not known, a number of tools are available, many on the Pickering distribution disk, to allow the IP address to be discovered.

Step 1 - Enable Security

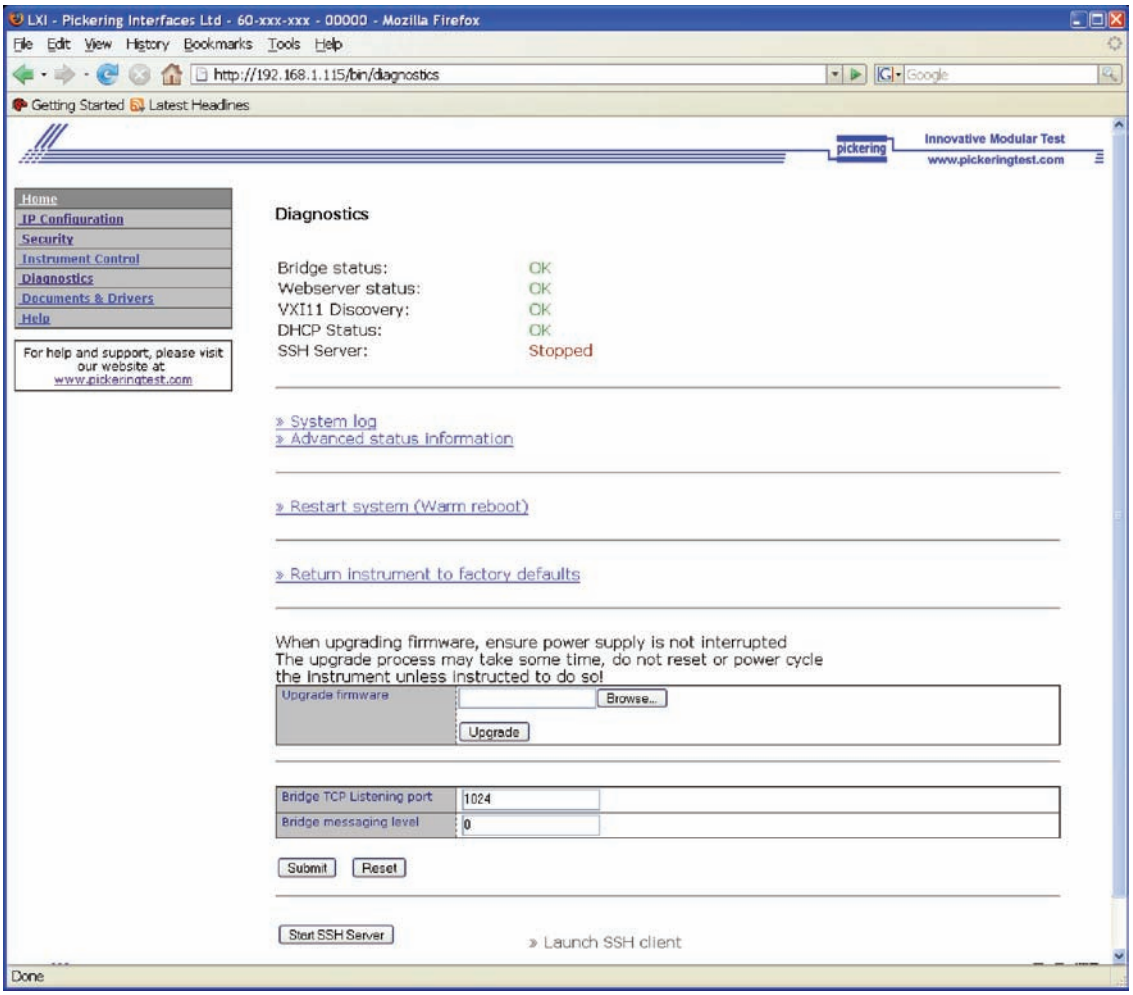
Select the Security Page from the main menu list

Enter a password and confirm then click on the Submit button.

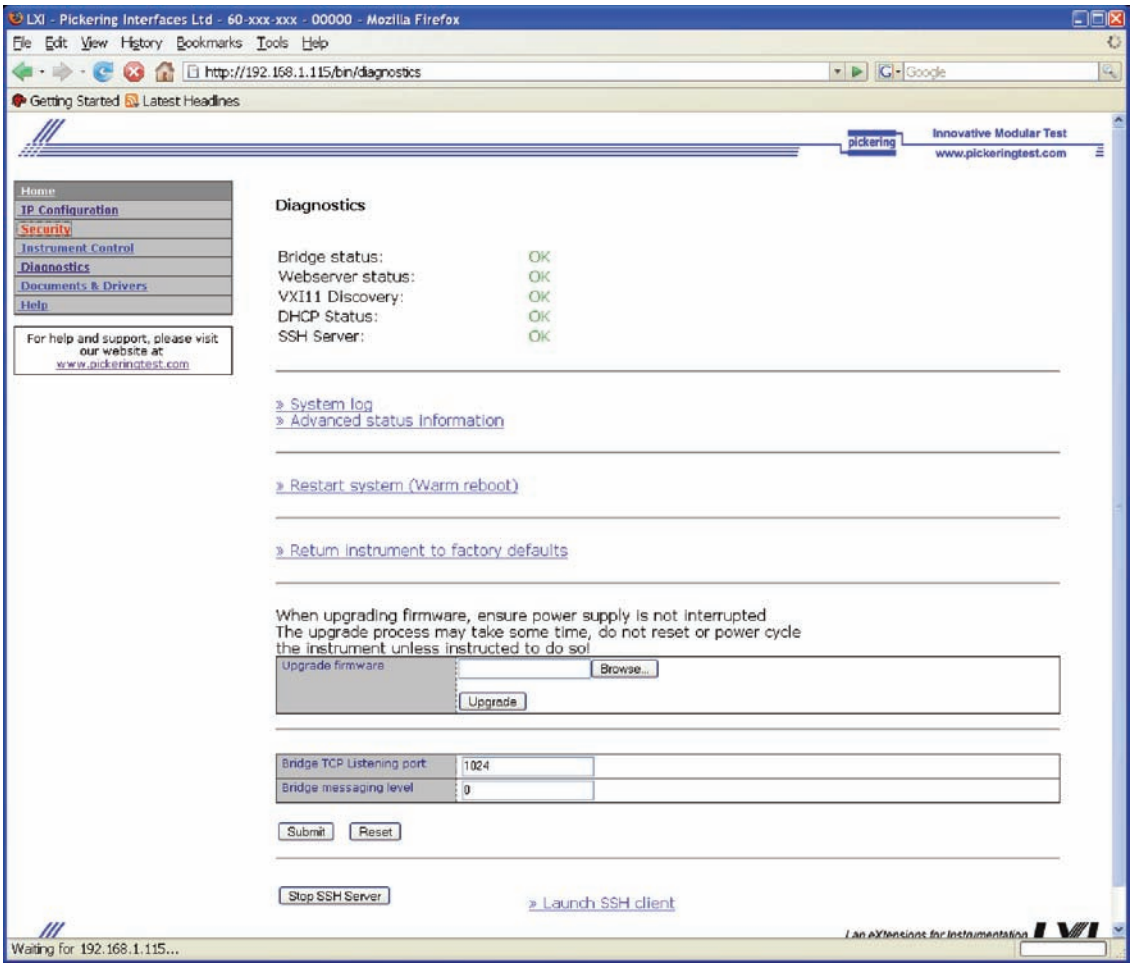
Step 2 - Enable the SSH server

Select the Diagnostics page from the main menu

Note: after a password is set, access to most web pages is controlled by security and you will need to enter a username and password to gain access. The username is “admin” and the password is that which was set on the security screen.



Click on Start SSH server



The SSH server is now operative and instrument control access is available from an external SSH client application.

NOTES:

The password and state of the SSH server are stored in non-volatile memory within the LXI instrument and so will remain in effect even after a power cycle. It is important to remember the password applied. Should the password be forgotten, the instrument may be reset to initial conditions by operating the reset button located at the rear of the instrument in the appropriate manner, refer to the LXI product manual for details of this process.

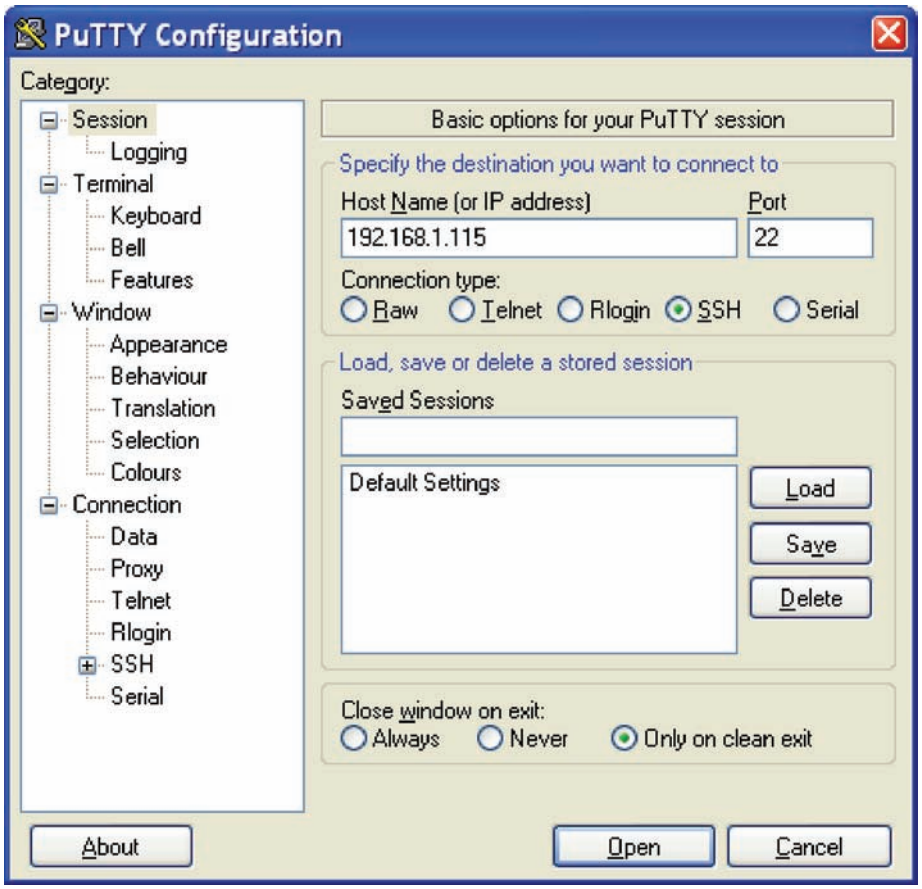
Disabling security will stop the SSH service.

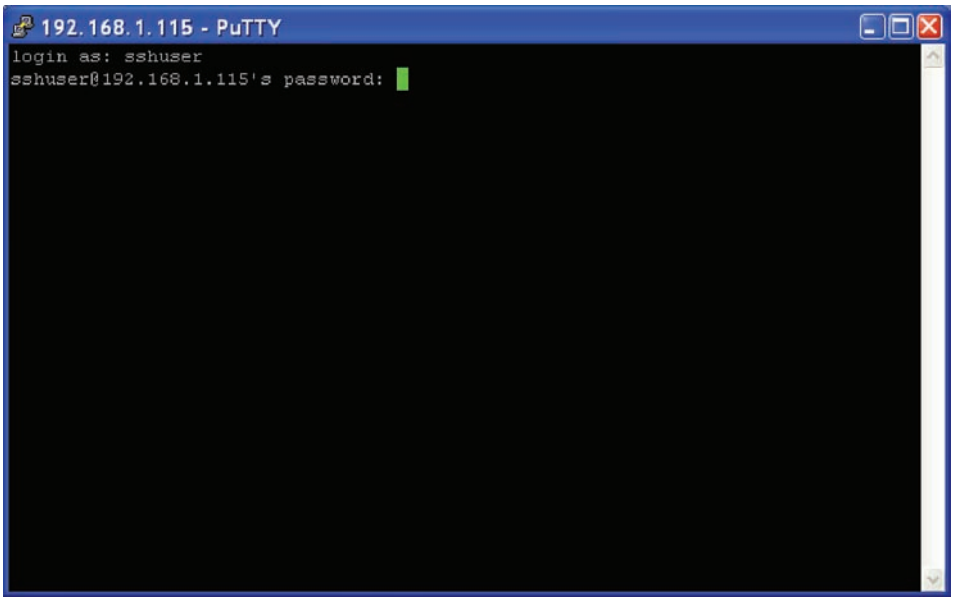
Instrument Control from an SSH Client

In the following examples the SSH client PuTTY is used, the user will have to adapt the instructions for any other client.

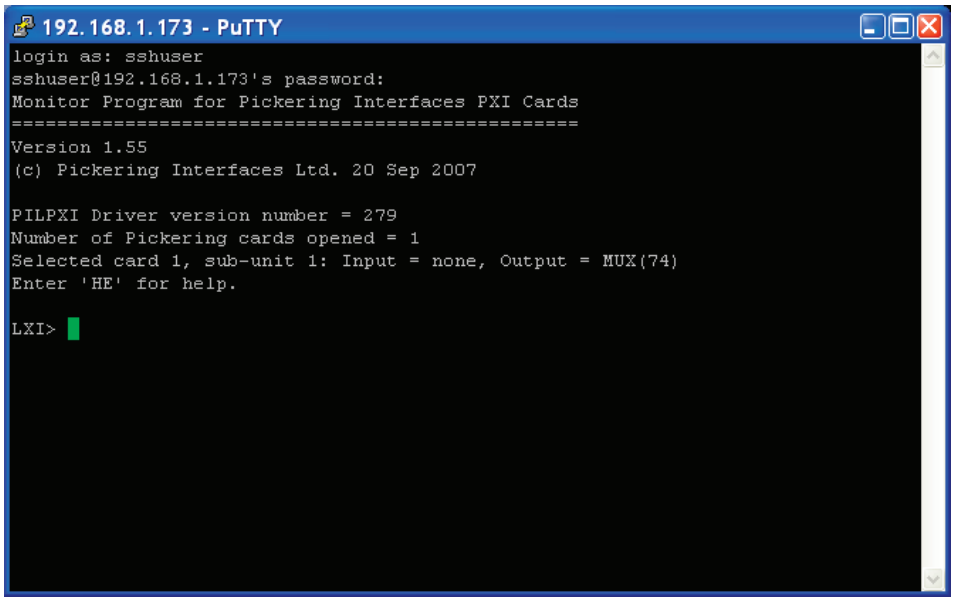
First start up the SSH client and enter the IP address of the LXI instrument. The user will be prompted for a login name and password.

The username for instrument control is 'sshuser', the password is that defined by the user when setting security.





Once the username and password have been supplied, the LXI instrument will enter an application providing a command line interface to the switch cards within the instrument.



When the application is expecting input, the prompt **LXI>** will be displayed. Card control is achieved using a set of mnemonics plus optional data. These mnemonics are based on the Direct IO driver pilpxi.dll.

Brief details of operation is given here, full documentation instruction set may be obtained by referring to the documentation for the pilpxi or pipx40 drivers and is available in a separate document.

By default, the application opens all available switch cards contained in the LXI instrument. This access is exclusive and prevents other users from accessing the cards thus preventing inadvertent operation switching functions from another location.

Typing **HE** in response to the prompt will list the entire command set avalailable.

These are listed in Appendix 1.

For any specific operation the appropriate command must be chosen, here a a few of the more commonly used commands:

Before attempting to control a card it is important to understand the switch architecture of that card and to know how to address the required switch. Each Pickering switch card is represented as a set of one or more sub-units, each sub-unit containing one or more switches. A sub-unit represents a collection of switches of similar type, it may represent an entire matrix, or a row of simple switches, or a power supply voltage setting.

In the case of a switch sub-unit, each switch is represented by a single bit of data and may be toggled between 0 and 1, 0 representing the off state of the switch relay and 1 representing the on state.

The precise relationship between bit positions and switch location is provided in the card manual, or by use of the LS command inside the utility program PILMon in Windows, or by the LXI SSH service application.

Commonly used mnemonic commands

LS Will list all the open cards, providing the Card Number of each which is essential for further control of a card, also provided are the details of the card model number and architecture.

AD This is used to select the card and sub-unit to which commands will be addressed.
For example to select the second sub-unit on the first card use **AD 1 2**

SC Closes a switch, needs additional bit position, eg **SC 1** energises switch 1

SO Opens a switch, also needs additional bit position

SV Obtains the current state of a switch, again bit position is required

SB Sets an entire sub-unit of switches to a binary pattern, requires additional data of a pattern of hexadecimal data, eg **SB FFFF** will energise 16 relays

CS Clears an entire sub-unit of switches

BV Used to view the current state of all the switches in a sub-unit

Many other commands are available including facilities to obtain status information, to manage masks which may be used to prevent operation of a switch or switches.

It is important to realise the difference between Read and View operations. Read is used to read back data from an input, VIEW to read back the current state of an output.

Example

AD 1 2	Selects card1, sub-unit 2
SC 3	Closes switch 3 on current sub-unit
AD 1 3	Selects card1, sub-unit 3
BV 5	Obtains state of switch 5 on current sub-unit

In the case of matrix sub-units, the XC and XO commands are useful, obviating the need for the user to calculate the bit position for a crosspoint in the matrix by allowing a point to be addressed by row and column address.

Appendix 1

```
LXI> he
PILMon commands:
  AD [<card> <sub_unit>]       = [select and] display card/sub-unit to address
  SC <number>                  = close output (set ON)
  SO <number>                  = open output (set OFF)
  SB <bit_pattern>             = set sub-unit outputs (to hex bit-pattern)
  CS                           = clear OUTPUT sub-unit
  RS                           = clear all OUTPUT sub-units on all open cards
  ST                           = display status of currently-selected card
  BV                           = view sub-unit output states (as hex bit-pattern)
  BR                           = read INPUT sub-unit (as hex bit-pattern)
  LS [<card>]                  = list info on all open cards, or specified card
  EC <0|1>                     = turn serial echo OFF|ON (default = ON)
  WC <number> <value>          = write the calibration value for an output
  RC <number>                  = read the calibration value for an output
  LC                           = list calibration values
  DM <bit_pattern>             = set driver mode flags (to hex bit-pattern)
  AC <number>                  = matrix: close all points on single row or column
  CM                           = clear OUTPUT sub-unit mask
  SM <number> <0|1>            = UNMASK|MASK an individual output
  MB <bit_pattern>             = set OUTPUT sub-unit mask (to hex bit-pattern)
  MV                           = view sub-unit output mask (as hex bit-pattern)
  OC                           = take control of all Pickering switch cards
  CC                           = release control of all Pickering switch cards
  VO <bus> <slot>              = open card at specified location
  VC <card>                    = close specified card
  HE|HL                        = show this help information
  SV <number>                  = show state of specified output
  MS <number>                  = show mask state of specified output
  IS <number>                  = show state of specified input
  AR                           = clear all OUTPUT sub-units of the current card
  XC <row> <column>            = close matrix crosspoint
  XO <row> <column>            = open matrix crosspoint
  XV <row> <column>            = show state of a matrix crosspoint
  XM <row> <column> <0|1>      = UNMASK|MASK a matrix crosspoint
  XS <row> <column>            = show matrix crosspoint mask state
  DI                           = show diagnostic information
  SE                           = show sub-unit settling time (µs)
  CL                           = show sub-unit closure limit
  SS                           = show sub-unit status
  PT                           = show PSU type description
  PI                           = show PSU information
  PS <fp value>                = set PSU output voltage
  PV                           = show PSU output voltage setting
  PE <0|1>                     = DISABLE|ENABLE the output of a PSU
  CF                           = show number of free cards
  LF                           = list bus/slot locations of free cards
  Q                            = quit the program
```

SECTION 7 - TROUBLESHOOTING

Q I have a power light and a ready light on the Controller module, but why does the LAN light flashes?

A If it is flashing green it is operating normally, this is used as visual identification to locate the chassis in a densely populated test rack environment.
If it is flashing red you have an IP conflict. That is another device on your network has the same TCP/IP address as your LXI chassis. Remove the conflict or change the IP address of your LXI chassis.

Q The power is on, but why doesn't the LAN indicator light up at all?

A There is a cabling fault. Check your Ethernet lead is of the correct type and is plugged into a working hub or switch. Most hubs and switches have a link indicator to show when the connection is correct.

Q Why do I have a red Error light on the Controller module, but the Ready and Power lights are on?

A Most likely cause is that peripheral cards have not been installed in the chassis. Power down the LXI chassis and install some cards.

Q Why do I have only a red Error and Power light on the Controller module?

A There is a hardware fault with your chassis, contact your local sales office.

OR, the chassis has been set with an invalid IP address. Obtain the required information as outlined in "Setting the IP Address" in Section 4, and perform a full reset as described below.

Q How do I know when I can begin communicating with my chassis?

A The LXI chassis has a Ready and Active light on the Controller module that indicate its current activity. Whenever the Active light is illuminated, the system is busy and may not be able to process other commands. This will normally occur when a TCP/IP configuration change has occurred.

Q What does it mean when my LXI Controller module's lights are all on, or flash wildly?

A The system is booting up, these sequences are used to monitor the LXI chassis boot progress as an aid to fault finding. Until the Controller module Ready light is illuminated green, you should not attempt to communicate with the chassis.

Q All of my Controller module's lights are on, why don't I see a green Ready light even after a few minutes?

A Your chassis has a fault, contact your local sales office.

Please contact your local Pickering Interfaces sales office for any further support or email:
Lxisupport@pickeringtest.com

You can also visit our website for product updates, help and downloadable materials at:
http://www.pickeringtest.com

UNIT RESET

If the chassis operation is inconsistent the user should try resetting using the recessed button on the Controller module's front panel to see if this effects a cure.

Momentary operation of the button causes a reset of the unit, this is similar in effect to cycling the power.

Holding the button depressed for a period of about 5 seconds causes the chassis to be set back to factory default conditions. This will destroy any user configuration data already entered, reset the IP address and put the LAN interface into DHCP and Auto mode.

Alternatively, if the chassis operation over a network is still in doubt, connect it to a laptop using a crossover cable and set it up as described in "Configuring the LXI Device Isolated from a Network" in the "LXI Getting Started Guide".

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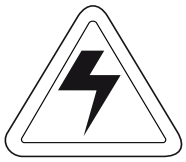
SECTION 8 - WARNINGS & CAUTIONS



WARNING - DANGER OF ELECTRIC SHOCK

THIS CHASSIS CONTAINS HAZARDOUS VOLTAGES. BEFORE REMOVING THE OUTER COVERS REMOVE ALL SUPPLIES.

CAUTION
Handling of Electrostatic-Sensitive Semiconductor Devices

Certain semiconductor devices used in the equipment are liable to damage due to static voltage. Observe the following precautions when handling these devices in their unterminated state, or sub-units containing these devices:

(1) Persons removing sub-units from an equipment using these devices must be earthed by a wrist strap and a resistor at the point provided on the equipment.

(2) Soldering irons used during the repair operations must be low voltage types with earthed tips and isolated from the mains voltage by a double insulated transformer.

(3) Outer clothing worn must be unable to generate static charges.

(4) Printed Circuit Boards (PCBs) fitted with these devices must be stored and transported in anti-static bags.

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APPENDIX A - RACK MOUNTING THE CHASSIS

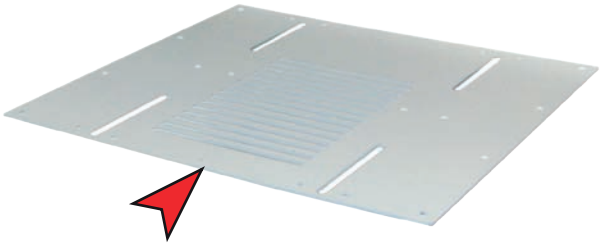
To allow the 60-102 chassis to be fitted in a 19 inch equipment rack it can be simply mounted on a standard equipment shelf, or preferably, it can be fitted with the 63-102-001 rack mounting kit. The kit allows the chassis to be securely fixed in a rack with top and bottom spacing to provide the correct flow of cooling air.

The following procedure describes the procedure for constructing the rack mounting kit and fitting the 60-102 chassis, assembly requires a No. 1 cross head screwdriver.

The contents of the kit is as follows:

- Base Panel
- Left and Right L-shaped side supports
- Front Panel
- 2 off Chassis Mounting Brackets
- 2 off Rack Handles
- 31 off Countersunk Screws
- 4 off Flat Washers

1. Take the Base Panel and identify its front edge (the ventilation slots are closest to the front) as highlighted in the figure. The underside of the Base Panel has the countersinking for the fixing screws



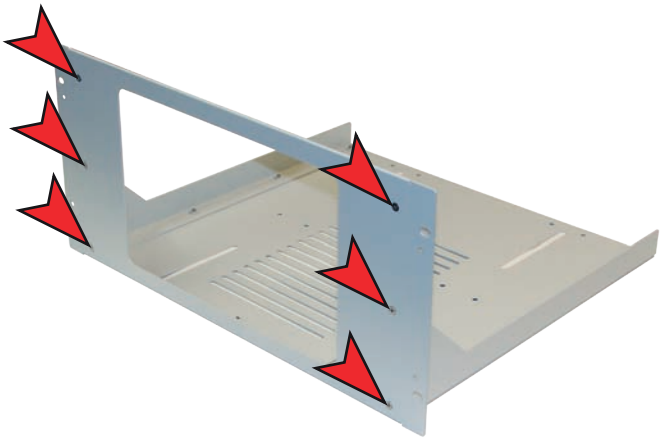
2. Position the Left and Right L-shaped side supports on the upper side of the base panel so that the shorter leg of the support is flush with the front of the base.

3. Secure the supports using 6 screws, fitted from the underside of the base panel. Use 3 screws on each support as shown. At this stage, do not fit screws in the holes closest to the front of the base panel.

4. The assembly orientated the correct way up should look like the figure on the right.

5. Next, position the front panel against the front of the side supports so that the lip on the panel's long edge is underneath the front edge of the base panel.

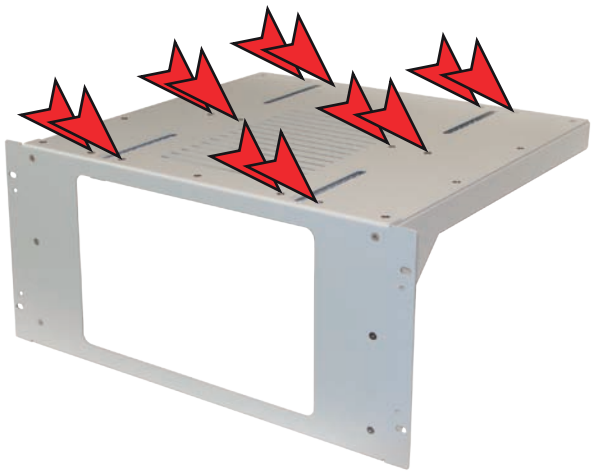
6. Secure the front panel with 6 screws as shown.



7. Invert the assembly and secure the lip on the lower edge of the front panel to base with 3 screws as shown.

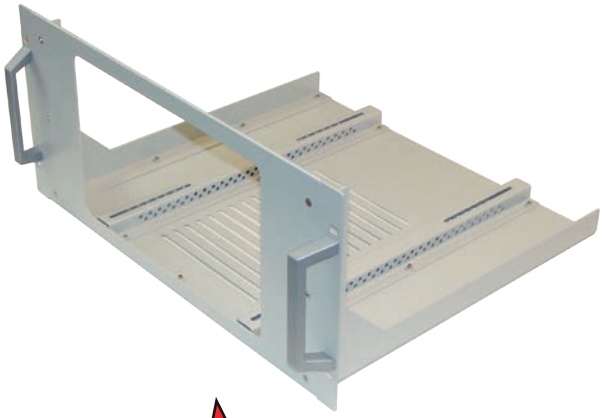
8. With the assembly the correct way up, position the two chassis support brackets on the top side of the base as shown.

9. Secure the chassis support brackets to the base with 12 screws fitted from the underside as shown.



10. Position the two rack handles to the left and right of the front panel and secure with 4 screws fitted from the rear of the panel as shown.

11. The finished rack mounting frame should look like the picture.



12. To fit the 60-102 Chassis into the rack mounting frame, the desk mounting feet have to be removed. First, turn the chassis upside down and pull out the rubber pads from each of the plastic foot mouldings as shown.

13. The fixing screws should now be visible. Unscrew the feet and retain the screws. The 4 feet fixing holes shown are used for securing the chassis in the frame.

14. Next, invert the frame and place it over the underside of the chassis so that the front panel fits through the aperture in the front of the frame. It will help to have the top edge of the chassis over-hanging the work bench by a one or two centimetres to allow clearance for the top of the frame.

15. Line up the slotted holes in the underside of the frame with the feet fixing holes in the chassis. Fit each of the 4 feet fixing screws with a washer and lightly secure each screw into one of the 4 holes in the chassis in the positions shown.

16. If necessary, move the chassis in the frame so that it is square with the front panel. Then tighten the four screws.

17. Finally, turn the frame/chassis assembly the correct way up, and it is ready to be fitted into a 19 inch rack.

WARNING: The fixing holes in the front of the rack mounting frame are designed only for securing the assembly in the rack and must NOT be used to support the weight of the whole unit. The weight of the unit must be supported by side brackets, runners or a suitable equipment shelf.